

AKCE : **REKONSTRUKCE KTV TUL HARCOV**  
**Na Bohdalci 715, Liberec XV – Starý Harcov**

**STATICKÝ VÝPOČET**  
**NOSNÝCH PRVKŮ**

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**V Liberci – červen 2019**

**Výpočet obsahuje 19 stran včetně titulního listu**

**OBSAH :**

<b>2.PP – nové schodiště</b>	<b>str. 3</b>
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<b>2.NP – sklad nad schodištěm</b>	<b>str. 13</b>
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**POUŽITÉ ČSN A PODKLADY :**

**ČSN EN 1991-1-1 – Objemové tíhy, vlastní tíha a užitná zatížení pozemních staveb**

**ČSN EN 1993-1-1 (73 14 01) – Navrhování ocelových konstrukcí**

**ČSN EN 1995-1-1 (73 17 01) – Navrhování dřevěných konstrukcí**

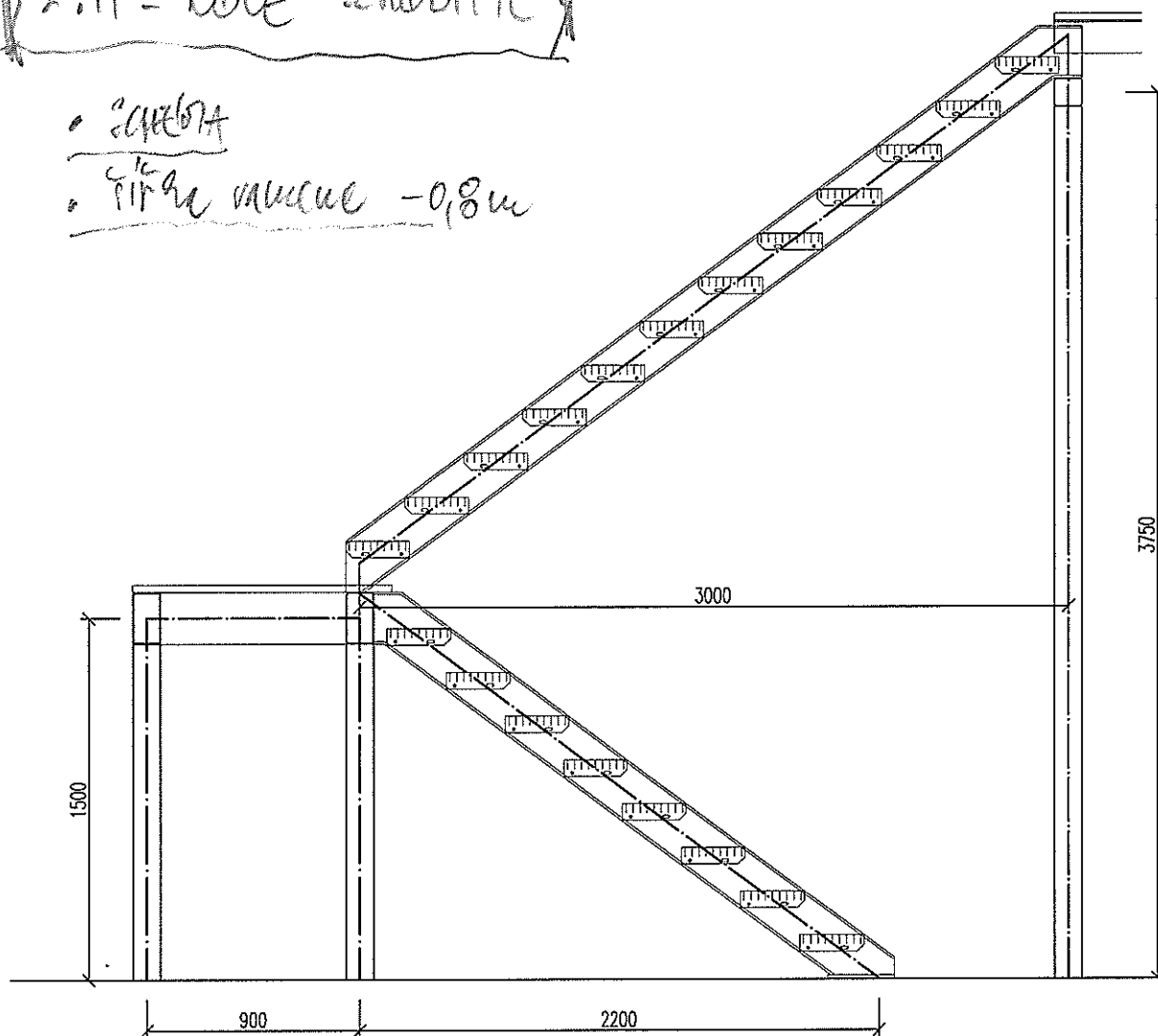
**Tabulky únosnosti lepených kotev Hilti, pororoštů a OSB desek**

# 2. PP - NOVÉ SCHODITĚ

3

• schůďa

• výška schůďa - 0,8 m



• schůďa

1. schůďa -  $\gamma = 1,2$

• schůďa schůďa schůďa  $\approx 0,15 \text{ m}^2/\text{m}^2$

• schůďa schůďa  $\approx 0,15 \text{ m}^2/\text{m}^2$

• schůďa schůďa O.K.

2. schůďa -  $\gamma = 1,3$

$p = 4,0 \text{ m}^2/\text{m}^2$

$P = 2,0 \text{ m}^2$

1) STUPEN

norma

$$800 + 270 - 70 \times 2$$

$$F_v = 26,2 \text{ g/m}^2, \quad F_p = 3,2 \text{ g/m}$$

$$F_{max}^v = 0,45 + 4,0 = 4,45 \text{ g/m}^2 \ll F_v$$

$$F_p^{max} = 2,0 \text{ g/m} < F_p = 3,2 \text{ g/m}$$

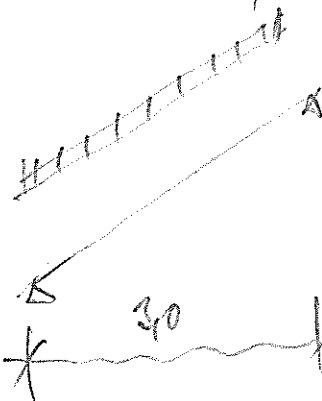
$\Rightarrow$  OK

2) sečnice

$$z_{d.f.} = 0,5 \text{ m}$$

- konstanta LFE 220 - 21,1 g/m

$$W = 194 \text{ m}^3, \quad g = 2120 \text{ m}^3$$



$$g^u = 0,5 (0,45 + 4,0) + 0,15 + 0,24 = 2,16 \text{ g/m}^2$$

$$g^v = 0,5 (0,45 \times 1,2 + 4 \times 1,2) + 0,26 \times 1,2 = 3,2 \text{ g/m}^2$$

$$x^u = 2,9$$

$$x^v = 4,95$$

norma

$$F_{max} = \frac{1}{8} \times 3,2 \times g^2 = 3,7 \text{ g/m}$$

$$\sigma_{max} = \frac{F}{A} = 20 \text{ MPa} \ll R_d = 210 \text{ MPa}$$

deformace

$$f_{max} = \frac{5}{384} \times \frac{2,6 \times 300^4}{2,1 \cdot 10^6 \times 2120} = 0,06 \text{ cm} \ll f_{dov}$$

$\Rightarrow$  OK

$$f_{dov} = \frac{L}{400} = 0,75 \text{ cm}$$

3. Роботний  
номір

(5)

$$p^u = 2 \times 3,9 + v.l.h_u = 8,0 \text{ кН}$$

$$p^v = 2 \times 4,9 + v.l.h_v = 10,5 \text{ кН}$$

Ja  $120 \times 120 \times 6$  - консольний

$$W = 221,7 \text{ см}^3; \quad \gamma = 2439 \text{ см}^4$$

(u)

$$M_{max} = \frac{1}{4} \times 10,5 \times 2,05 = 5,4 \text{ кНм}$$

$$\sigma_{max} = 25 \text{ МПа} \ll R_d$$

(b)

$$f_{max} = \frac{1}{48} \times \frac{800 \times 205^3}{2,1 \cdot 10^6 \times 2439} = 0,03 \text{ см} \ll f_{dov}$$

$$f_{dov} = 1/400 = 0,5 \text{ см}$$

$\Rightarrow$  ВІПОВІД

4. номір

Ja  $120 \times 4$  - -  $A = 18,15 \text{ см}^2; \quad i = 4,71 \text{ см}$

$$P_{max} = 4,95 + \text{"номі"} \text{ падіна} = 10,0 \text{ кН}$$

випадок

$$L_{cr} = 375 \text{ см}; \quad k = 80; \quad \varphi = 0,77$$

$$\sigma_{max} = \frac{P}{A} = 5,5 \text{ МПа} \ll \gamma R_d = 161,7 \text{ МПа}$$

$\Rightarrow$  ВІПОВІД

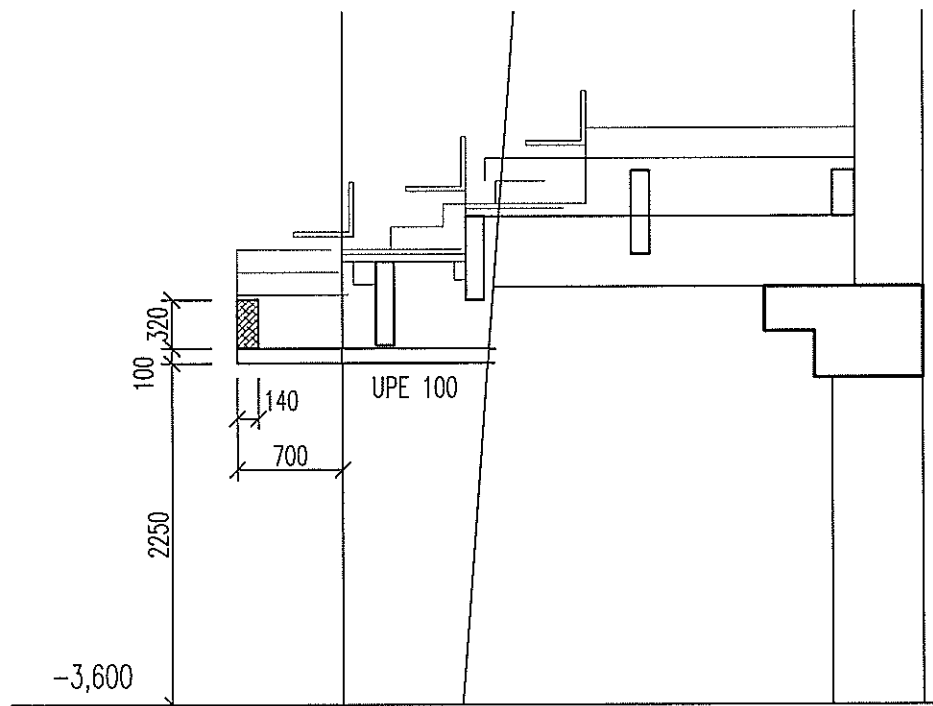
1.00 ПРОХОДОВЫЙ  
ТРУБЫ

6000

Труба

оружейка

700



zátěžem!

$$q_{x'k} \dots \gamma = 1,2$$

$$\bullet \text{ podlahy, sok} \dots = 0,3 \text{ q}_{w/m^2}$$

$$q_{z'k} \dots \gamma = 1,3$$

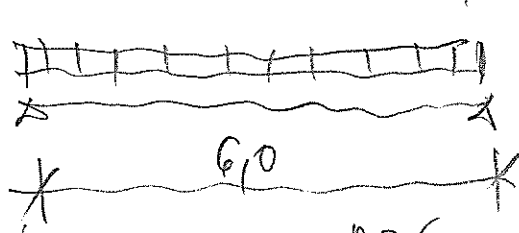
$$\bullet \text{ bříkna} \dots = 4,0 \text{ q}_{w/m^2}$$

podle textu:

BSP lepež, vřetovatý hranol 14/32

$$W = 2390 \text{ cm}^3; \quad y = 38229 \text{ mm}^4$$

zat.č - bříkna  
0,7 m



$$q^H = 0,7(0,3 + 4,0) \text{ q}_{w/m} = 3,1 \text{ q}_{w/m}$$

$$q^V = 0,7(0,36 + 5,2) + 0,33 = 4,2 \text{ q}_{w/m}$$

úložnost:

$$\sigma_{max} = \frac{1}{8} \times 4,2 \times 6^2 = 18,9 \text{ q}_{w/m}$$

$$\sigma_{max} = \frac{M}{W} = 7,9 \text{ MPa} \ll R_{fl} = 18 \text{ MPa}$$

DEFORMATION:

$$f_{max} = \frac{5}{384} \times \frac{3,1 \times 600^4}{100000 \times 38229} = 1,5 \text{ cm} < f_{dov}$$

$$f_{dov} = l/200 = 20 \text{ cm}$$

OK

reakce



$$A^H = 9,9 \text{ kN}$$

$$A^V = 12,6 \text{ kN}$$

[illegible]
$$W = 34,6 \text{ m}^3$$
$$A = 170 \text{ cm}^2$$
$$\eta_{max} = 12,6 \times 0,7 = 8,8 \text{ Sum}$$

$$\sigma_{max} = \frac{W}{F_t} = 254 \text{ MPa} - \text{maglion}$$

Wahl = 45 m<sup>2</sup> ⇒ UPE 120 - w/5 5/12/202

$$\sigma_{mq} = 171,8 \text{ MPa} < R_d = 210 \text{ MPa}$$

**DEFORMATION:**  $\delta_{max} = \frac{1}{3} \times \frac{990 \times 70^3}{211.10^6 \times 807} = 0.12 \text{ mm}$   $< f_{low}$

$$f_{\text{dec}} = 1/200 = 0.23 \text{ ms}$$

$\Rightarrow$  Wahy

konkret  
KE Gruppe:

myr (collateral)  $\therefore V_{myr} = 710 \text{ cm}$

8.8  $M_2$   $F_{upd} = \frac{1}{145} \times 2719 = 19.2 > 17.10 \text{ Gw}$

ATKXENI - Rohoduje

борщ

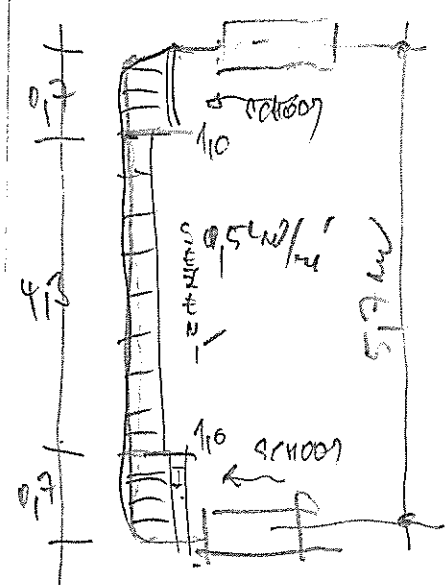
flak kolono uz valdus  $R_{akt} = 2,4 \text{ MPa} = 24 \text{ kg/cm}^2$  ✓

Answer - 14 1/2 hours ✓  
 $\frac{1200}{24} = 50 \text{ am}$  ✓  
 $\frac{120}{3 \times 19} = 57 \text{ am}$  ✓

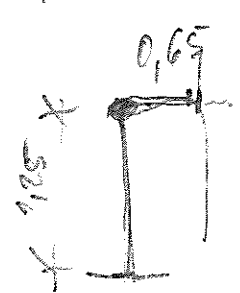
⇒ Act. "oscillation" obfuz do kopar + 720  
cca 1000



2-ABRADI

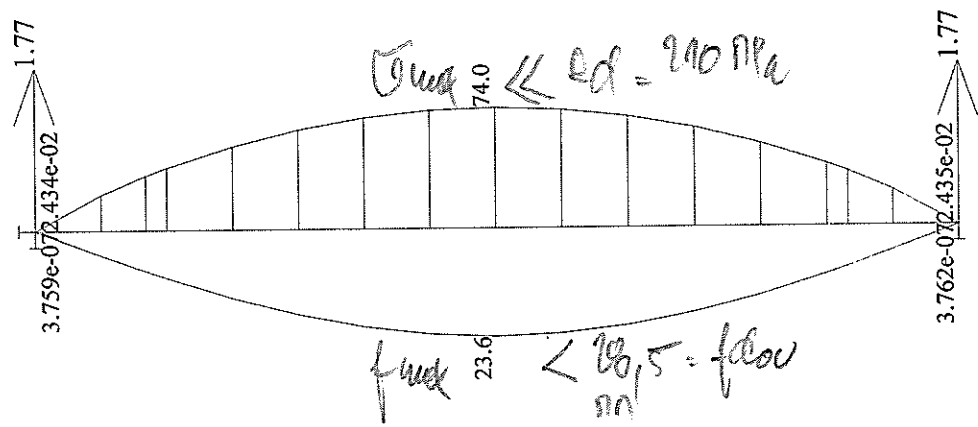


• 20610007  
 $f_{dev} = \frac{L}{200} = 2,85 \text{ m}$



• 1.0 m<sup>2</sup>/m<sup>2</sup> × 1.2 = 1.2  
 0.15

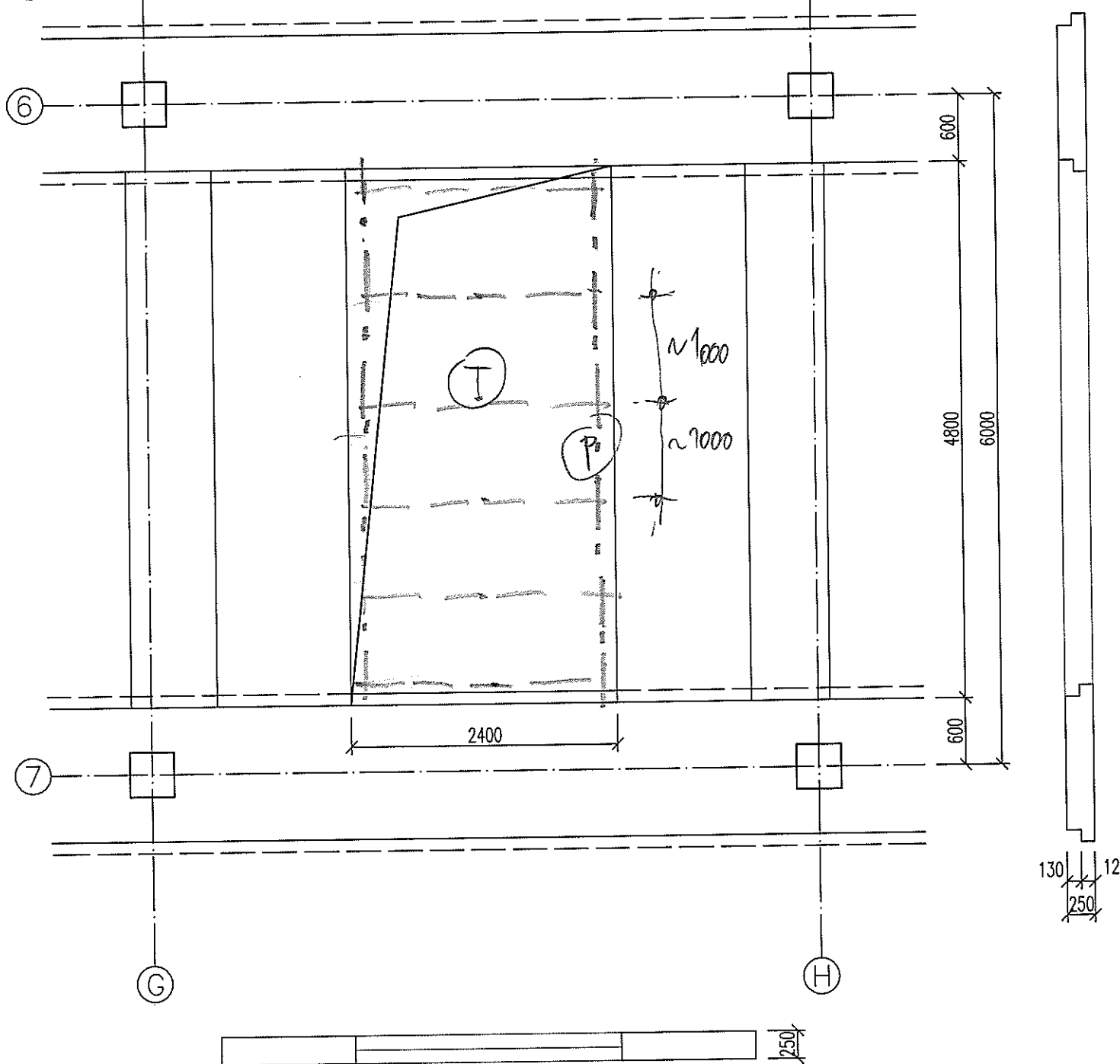
• TRφ 102 x 4 (UPE 100)



- ALT - UPE 100 - f = 22 m  
 UPE 80 40 m

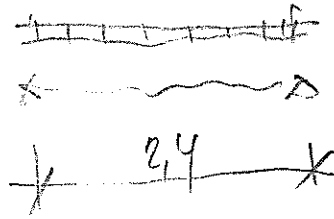
⇒ UPE 100

# 2.1.4. ZAKRSTI STANJILNIH OTVORA - DOKLEPI PROJEKCIJA (10)



ZATVORI : - STALCI ...  $H = 1,2$   
 • podlaga (sok)  $1,05m$  ... =  $1,2$   $5m^2$   
 • krovna ploha  $9m$   
 užitni ...  $H = 1,0$   
 • shromatovaci prostor - dno  
 $4,0$   $5m^2$

• brücke (T)  
a 1,0m  
(20/180)



$$g^u = 0,2 + u \cdot l_{\text{m}} + 4,0 = 4,5$$

$$g^v = 0,24 + u \cdot l_{\text{m}} + 5,2 = 5,8$$

Laufzeit

únosnost:

$$P_{\text{max}} = \frac{1}{8} \times 5,8 \times 2,4^2 = 4,29 \text{ MN}$$

drugo ...  $W_{\text{max}} = 450 \text{ m}^3$

$$\sigma_{\text{max}} = 9,8 \text{ MPa} < R_{\text{fd}} = \frac{10}{12,0} - w = 427 \text{ m}^2$$

$$j = 3413 \text{ m}^4$$

DEFORMATION

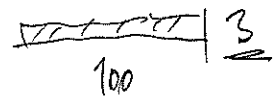
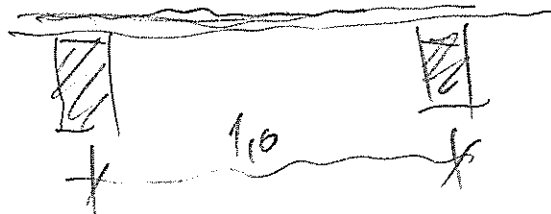
$f_{\text{dov}} = 1/600$  (oboluhá se behová! - prakticky bez deformací od užitíku seřazení)

$$f_{\text{max}} = \frac{5}{384} \times \frac{4,5 \times 2,4^4}{100000 \times 3413} = 0,16 \text{ cm} \quad 1/400$$

(12/18) ...  $j = 5832 \text{ m}^4$  ...  $f = 0,135 \text{ cm}$   
1/680

⇒ OK

• pr. most  
(6l. 20m)



$$W = 150 \text{ m}^3$$

$$j = 225 \text{ m}^4$$

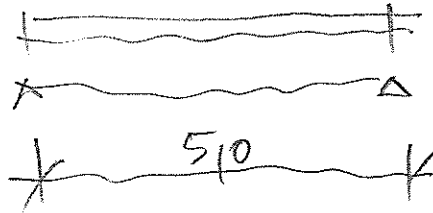
$$P_{\text{max}} = \frac{1}{10} \times 5,8 \times 1,0^2 = 0,58 \text{ MN} \dots \sigma_{\text{max}} = 3,9 \text{ MPa}$$

pr. most  $f_{\text{max}} = \frac{5}{384} \times \frac{4,5 \times 1,0^4}{100000 \times 225} = 0,26 \text{ cm} = 1/400$

+ spozitok  
⇒ OK

и пилла

(200x200x14)



12) 101.4m  
 $q_k = 1,2 \times 4,5 = 600 \text{ N/m}$

$q_r = 1,2 \times 5,8 = 715 \text{ N/m}$

иномон:

$M_{max} = \frac{1}{8} \times 7,5 \times 5^2 = 23,5 \text{ kNm}$

$W_{min} = 150 \text{ cm}^3$  деформация

$(200 \times 200 \times 14) \dots W = 143 \text{ cm}^3 - S = 2078 \text{ cm}^3$

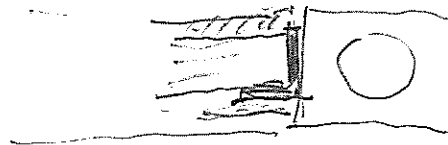
$\sigma_{max} = 164,7 \text{ MPa}$



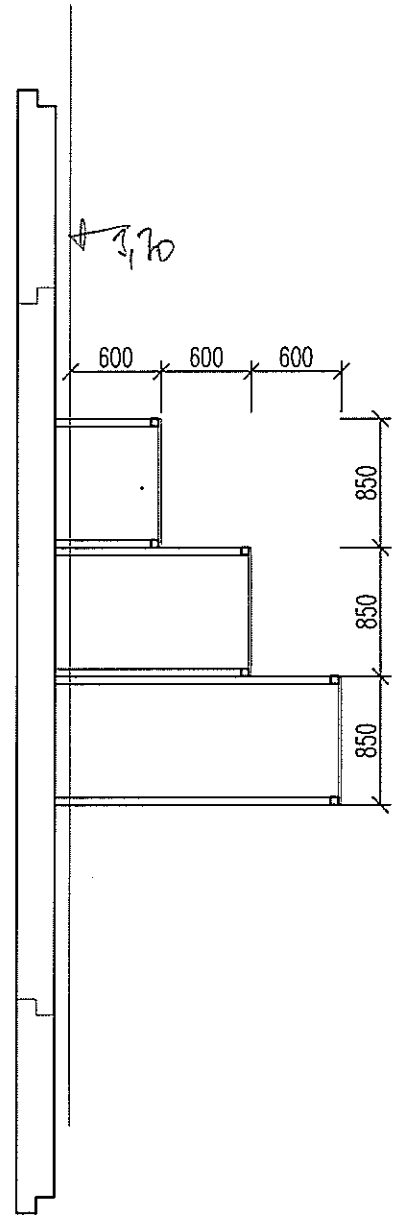
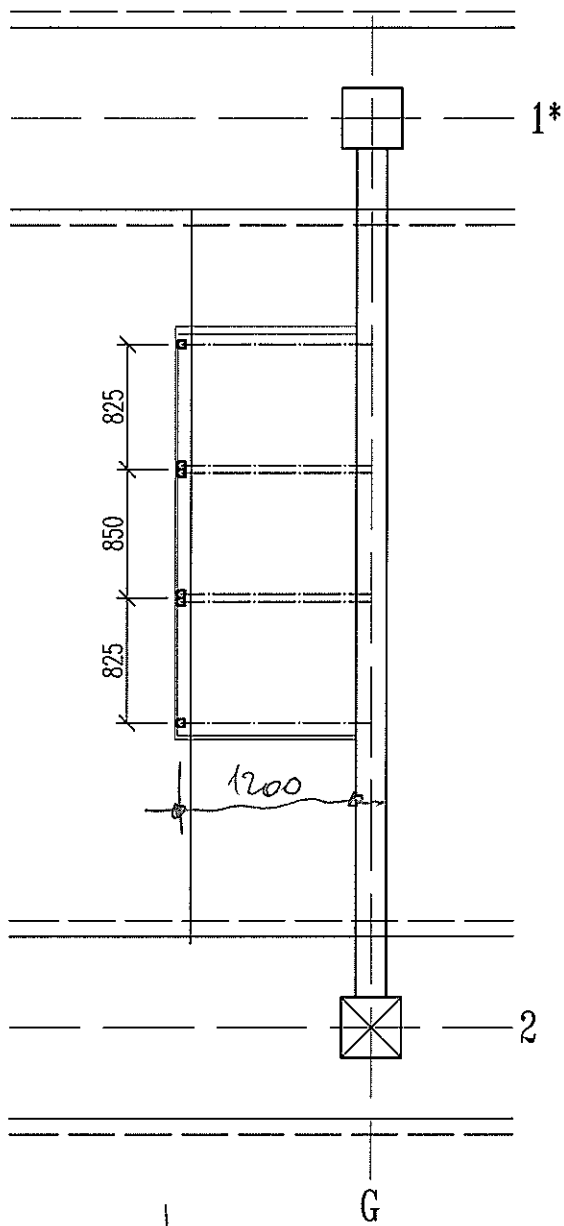
деформация:

$f_{max} = \frac{5}{284} \times \frac{610 \times 500^4}{2,1 \cdot 10^6 \times 2078} = 1,1 \text{ cm} - 1/450$

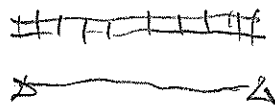
$f_{доп} = 0,8 \text{ cm}$   
 $= 1/660$



# 2.17- SKLAD NA D ROKODITSE



1. OSB 18



$$1200 \cdot 825 \cdot 2 \cdot 2 = 20 \text{ m}^2 \text{ } \checkmark = \phi$$

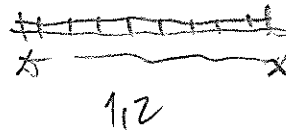
(2) WOLNY  
PROFIL

konstrukcijski

J<sub>a</sub> 50 x 2  
300 g

$$\begin{aligned} W &= 5166 \text{ cm}^3 \\ S &= 14,15 \text{ cm}^4 \\ A &= 3,74 \text{ cm}^2 \\ I' &= 195 \text{ cm}^4 \end{aligned}$$

(2.1) podvornica čar



$$q_k = 2,0 \times 0,45 + \text{ul. l.} = 1,09 \text{ kN/m}$$

$$q^* = 1,3 \text{ kN/m}$$

(u)

$$M_{\max} = \frac{1}{8} \times 1,3 \times 1,2^2 = 0,235$$

$$\sigma_{\max} = \frac{M}{W} = 44,2 \text{ MPa} < R_k = 210 \text{ MPa}$$

(f)

$$f_{\max} = \frac{5}{384} \times \frac{1,0 \times 120^4}{2,1 \cdot 10^6 \times 14,15} = 0,11 \text{ cm} \ll f_{\text{dov}} = \frac{120}{200} = 0,6 \text{ cm}$$

(2.2)

nikla čar

$$I_{\text{cr}} = 195 \text{ cm}^4$$

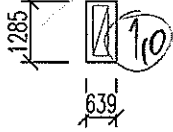
$$k \approx 100 \text{ } \varphi = 0,6$$

$$M_{\max} = 2,5 \times 0,45 \times 0,6 = 0,78 \text{ kN}$$

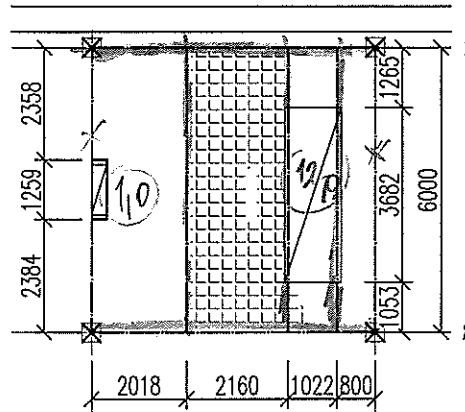
$$\sigma_{\max} = \frac{M}{W} = 1,2 \text{ MPa} \ll \varphi R_k = 126 \text{ MPa}$$

⇒ OK

ОЦЕЛОВА' КСЕ - про VBT  
 ПІВЕЧА  
 (отрп + GSS)

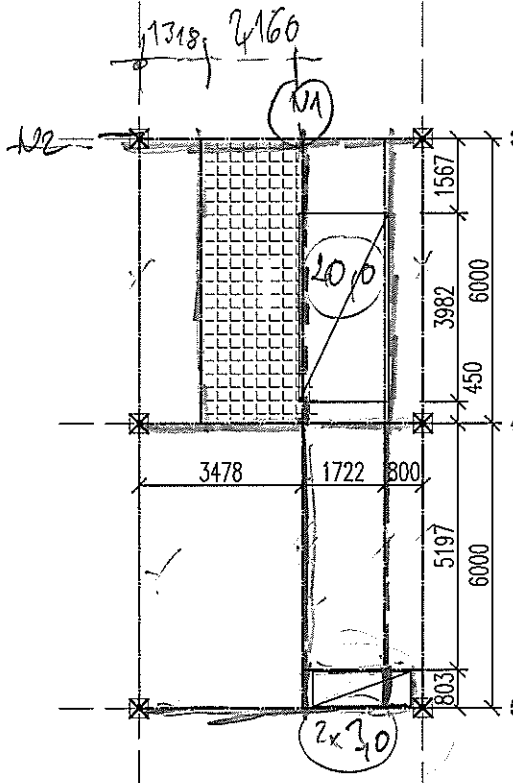


ВАПІВЕЧ  
 [KVO]

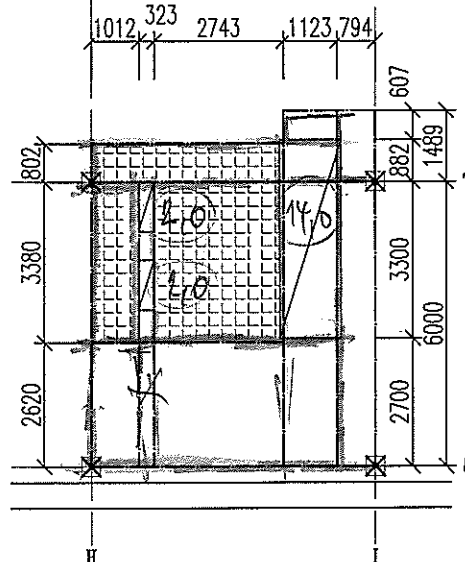
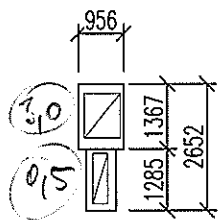


15

HEX 146



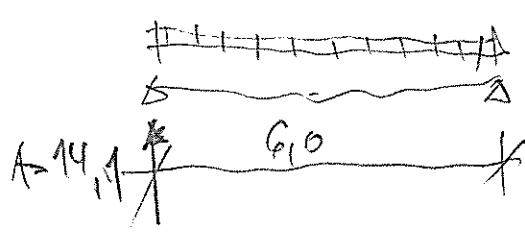
HEX 140



HEX 140

• DOMK7  
(N1) -  
HEA 140

max. zátěž' p/m



$q_u = q_u$

$\frac{2.16}{2} \times 2.0 + \frac{20}{4} \times \frac{1}{2} = 4.7$

rad/m  
utiliz  
2.2  
2.5

$\Pi_{max} = \frac{1}{8} \times 4.7 \times 6^2 = 21.2 \text{ kNm}$

$W_{min} = 150 \text{ cm}^3$   
deforce!!

HEA 160 220/1670

20.4

• HEA 140 KE/1030  
24.7

IPK 200 114/1940  
22.4

$f_{kor} = \frac{1}{200}$   
 $= 3.0 \text{ mm}$

$f_{max} = \frac{5}{384} \times \frac{4.7 \times 600^4}{21 \cdot 10^6 \times 1030} = 3.67 \text{ mm}$

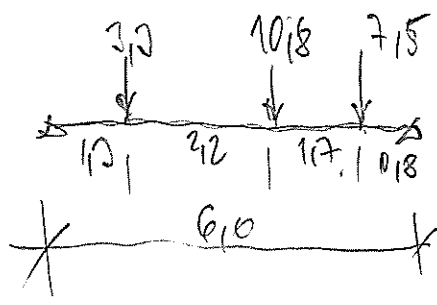
HEA 140

utiliz 200 mm/m  
 $\Rightarrow 1.0 \text{ mm/m}^2$   
 $f = 2.8 \text{ mm}$   
max

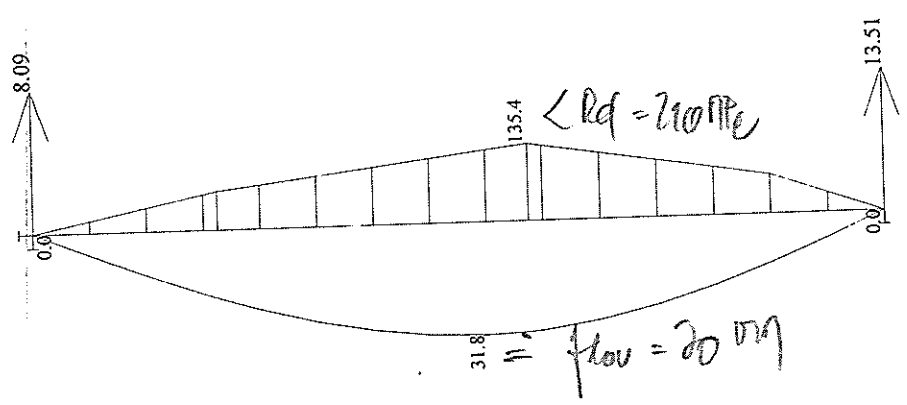
$A = 10.8 \text{ cm}^2$

$\Rightarrow \sigma_{max}$

(N2)



HEA 140



$\Rightarrow \sigma_{max}$



17

• Porocnost

$$- \text{pro } F_{v, \max} = 10^9 \text{ N/m}^2 \\ F_{p, \max} = 40 \text{ MPa}$$

$$x = 2,1$$

$$2,2$$

$$\boxed{50/3}$$

$$6,9 > 1,0$$

$$2,5 > 2,0$$

l<sub>max</sub>

$$- \text{že } (2,5 \text{ m})$$

$$4,77 > 1,0$$

$$1,95 = 2,0$$

• Stětní  
pánev

$$- \text{POS} - \text{TL} 140 \text{ MPa} \quad \dots \quad p_{\text{pos}} = 3,3 \text{ MPa}$$

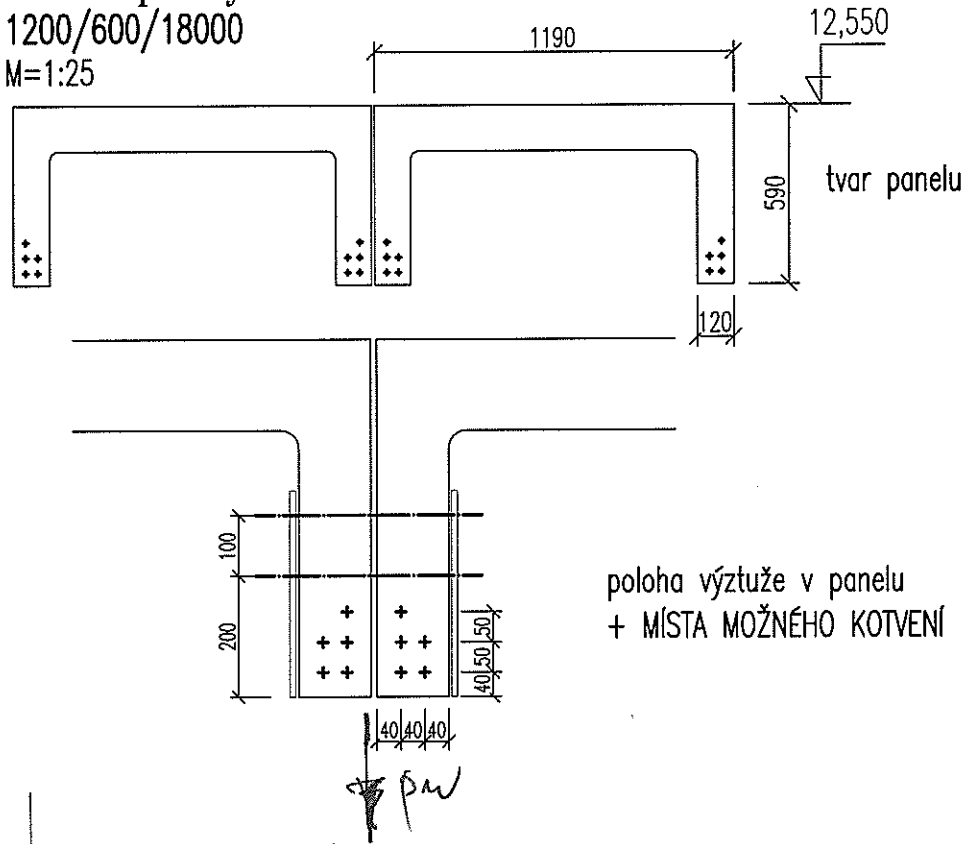
$$- \text{Překročí vždy } 200 - < \frac{150 - p_{\text{pos}}}{150 - \text{TEP} + \text{hydroizolace}}$$

⇒ bude na míru přizpůsobeno  
pauze porocnost podprah

zakázky  
OK pro kore

18

střešní panely  
1200/600/18000  
M=1:25



úvodní  
panelu

- 1 PD 25(24) - žip up. - 18 m

$$M_g^u = 399,81 \text{ Nm} \quad ; \quad q_{dov}^u = 3,56 \text{ Nm}^2$$

průřez

celá p.k. 550 g + ruče v níže kotven (uprostřed rozpětí) 240 g

bezpečí  $p^u = 300 \text{ g} = 3,0 \text{ Nm}$

$$\Delta \eta = \frac{1}{4} \times 3 \times 18 = 13,5 \text{ Nm} \times M_g^u = 400 \text{ Nm}$$

příně 3,4% - zjednot



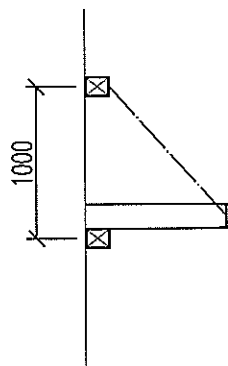
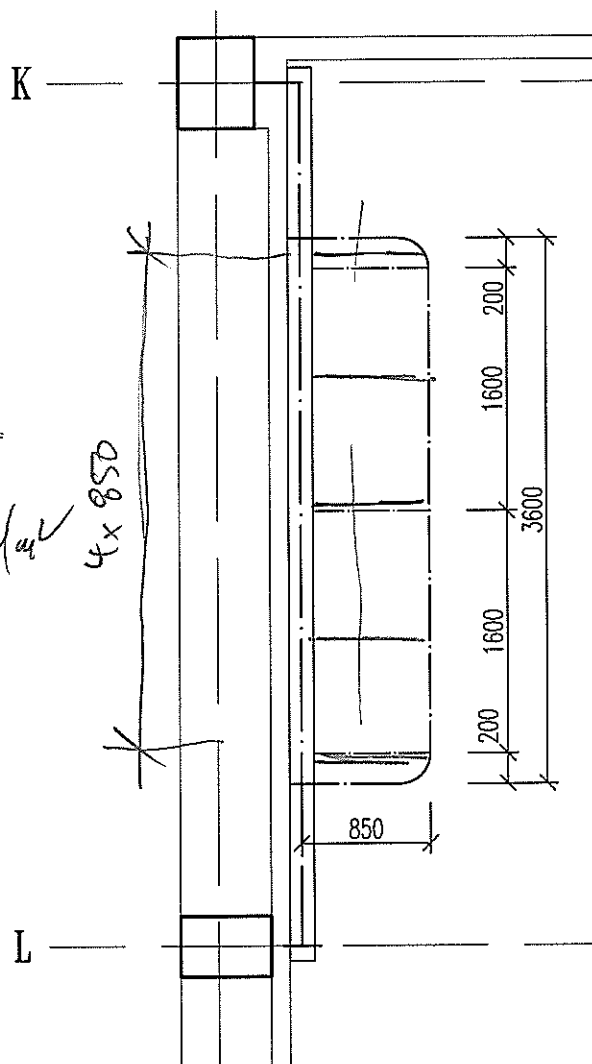
naše budoucí stav 30 Nm

DVA panely  $\Delta \eta = 1,7\%$

ГОРЕЉИЦА  
појачање по видео

OSB 18

$$g_{\text{гор}} = 210 \text{ W/m}^2 \quad 4 \times 850$$



по нел  
март

$$g_{\text{гор}} = 0,85 \times 210 = 177 \text{ W/m}^2$$

$$g_{\text{гор}} = 177 \times 1,2 = 212 \text{ W/m}^2$$

(u)

$$P_{\text{гор}} = \frac{1}{2} \times 212 \times 0,85^2 = 77,1 \text{ W/m} - W_{\text{гор}} = 1,0 \text{ m}^3$$

$$J_{\text{гор}} = 50 \times 20 \times 2 - W = 286 \text{ m}^2 \dots G_{\text{гор}} = 700 \text{ Pa} < R_{\text{g}}$$

$$\eta = 4,29 \text{ m}^2$$

(a)

$$f_{\text{гор}} = \frac{5}{789} \times \frac{177 \times 85^9}{21 \cdot 10^6 \times 4,29} = 0,110 \text{ m} = 1,2 \text{ m} = 1/650$$

$$\Rightarrow 0,1404$$